ECOLOGY OF THE CORALIVOROUS GASTROPOD *Coralliophila abbreviata*.
Population dynamics and life history (Miller et al)

The goals of this project, which began in 1998, were initially to document patterns of distribution of the corallivorous snail, *Corallophila abbreviata*, on it's two major coral host taxa, *Acropora palmata* and *Montastraea* spp. *(annularis* complex*)*, in the Key Largo sector of the upper Florida Keys, and to assess the impact these snails have on the corals in no-take and reference sites. The approach includes an annual survey of 6 sites with remaining live *A. palmata*, the apparently preferred prey but least abundant of the two coral hosts. Snail abundance patterns are examined with regard to the population characteristics of their host corals such as colony size and condition. Related studies have quantified snail consumption rates and various aspects of host-specific snail life history.

References:

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ECOLOGY OF THE CORALIVOROUS GASTROPOD *Coralliophila abbreviata*.
Population connectivity of the coralivorous gastropod *Coralliophila abbreviata*: larval dispersal potential and genetic structure. (Johnston and Miller)

Coral-eating predators are important members of a reef community, as they can affect coral population dynamics and community structure (Glynn 1990; Brawley and Adey 1982; Moran 1986; Hayes 1990; Knowlton et al. 1990; Turner 1994; Bruckner et al. 1997). *Coralliophila abbreviata* is a corallivorous gastropod that lives and feeds on several species of scleractinian coral throughout the Tropical Western Atlantic and the Caribbean. In light of catastrophic outbreaks of the coral-eating crown-of-thorns starfish (*Acanthaster planci*) in the Pacific, early investigators in the Caribbean concluded that *C. abbreviata* was not a significant corallivore (Ott and Lewis 1972). Subsequent studies however, have revealed that although damage to massive and plating corals is often minimal, *C. abbreviata* snails cause substantial mortality of some of the major structural architects of reefs, the branching acroporid corals, *Acropora palmata* and *A. cervicornis* (Fig. 1; Brawley and Adey 1982; Hayes 1990; Knowlton et al. 1990; Bruckner et al. 1997; Miller 2001; Baums et al. 2003b) and are the primary source of chronic mortality of these corals in parts of the Caribbean (Miller et al. 2002; Grober-Dunsmore et al. 2006). A single snail can consume up to 1095 cm2 of live tissue per year (Baums et al. 2003b). In addition, *C. abbreviata* is a potential vector for a virulent disease affecting *A. cervicornis*, suggesting a synergistic impact on host populations above and beyond simple tissue consumption (Williams and Miller 2005).

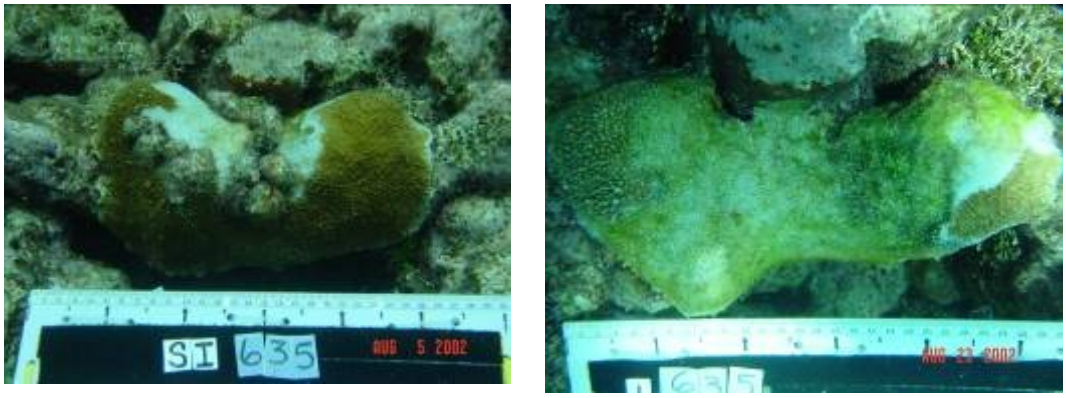

Fig. 1 Photographs showing an aggregation of *Coralliophila abbreviata* feeding on a small *Acropora palmata* colony (left) and the same coral colony less than one month later (right). Photos courtesy of Dana E. Williams.

Over the last three decades, *Acropora* spp. populations throughout the Caribbean have undergone widespread declines due to bleaching, disease, predation, and storms (Knowlton et al. 1990; Bruckner 2002; Miller et al. 2002) and have recently been listed as threatened species under the US Endangered Species Act (Anonymous 2006). As coral cover decreases, the effects of predation on remnant populations of these corals may be profound, as indicated by a report by Knowlton et al. (1990) that predation by *C. abbreviata* actually halted the recovery of *A. cervicornis* populations in Jamaica after a major hurricane. In addition to their role in reef accretion, the arborous branches of acroporid corals provided structural habitat for a variety of fishes and invertebrates, including commercially valuable species such as the Caribbean spiny lobster (*Panulirus argus*). Assessing and managing threats to the health of these reef building corals is thus essential for reef conservation in the region. Predation by *C. abbreviata* is one of the few threats that could potentially be directly managed through targeted snail removal (Miller 2001). In order to assess the ecological impacts and the effectiveness of such a management strategy, a full understanding of predator and prey life-histories and population dynamics is necessary.

The degree of connectivity or exchange among local populations has important ecological and management implications as it influences population dynamics and the genetic structure of a species. Local management may be effective for closed populations, whereas consistent replenishment from upstream sources confers resilience to local population fluctuations. Connectivity of populations of benthic marine organisms is dependent on the dispersal of planktonic larvae. The dispersal potential of planktonic larvae is dependent on several factors including adult reproductive strategies (mode, season, and frequency of reproduction), pelagic larval duration (PLD), and larval behavior (Sponaugle et al. 2002; Cowen et al. 2006). Successful recruitment of benthic marine organisms also requires that larvae

come in contact with suitable settlement habitat. Since adult habitat usually represents a relatively small portion of the area that may be encountered while in the plankton, larvae often settle in response to chemical or physical cues that are specific to critical resources such as habitat, food, and adult conspecifics. The specific cue(s) that induce larvae to settle may determine dispersal patterns and population distribution on both a local and regional scale.

Very little is known about the reproductive strategies or early life history of *C. abbreviata*: Female *C. abbreviata* brood a series of unattached egg capsules in the mantle cavity from which free swimming veligers emerge after being released. Veligers have been kept alive and swimming in the laboratory for up to two weeks (Wells and Lalli 1977; pers obs), but the PLD has not been truly quantified. We also do not know if *C. abbreviata* reproduce seasonally or continuously or what cue(s) induce veligers to settle and metamorphose. Thus, the dispersal potential of *C. abbreviata* veligers and the factors affecting snail distribution and host use are largely unknown.

The overall objectives of this project are 1) to estimate the dispersal potential of *C. abbreviata* veligers by determining the adult reproductive season and frequency, planktonic larval duration, larval settlement behavior and 2) to determine the genetic structure of *C. abbreviata* populations among hosts and locations on a Caribbean-wide scale, using highly polymorphic molecular markers.